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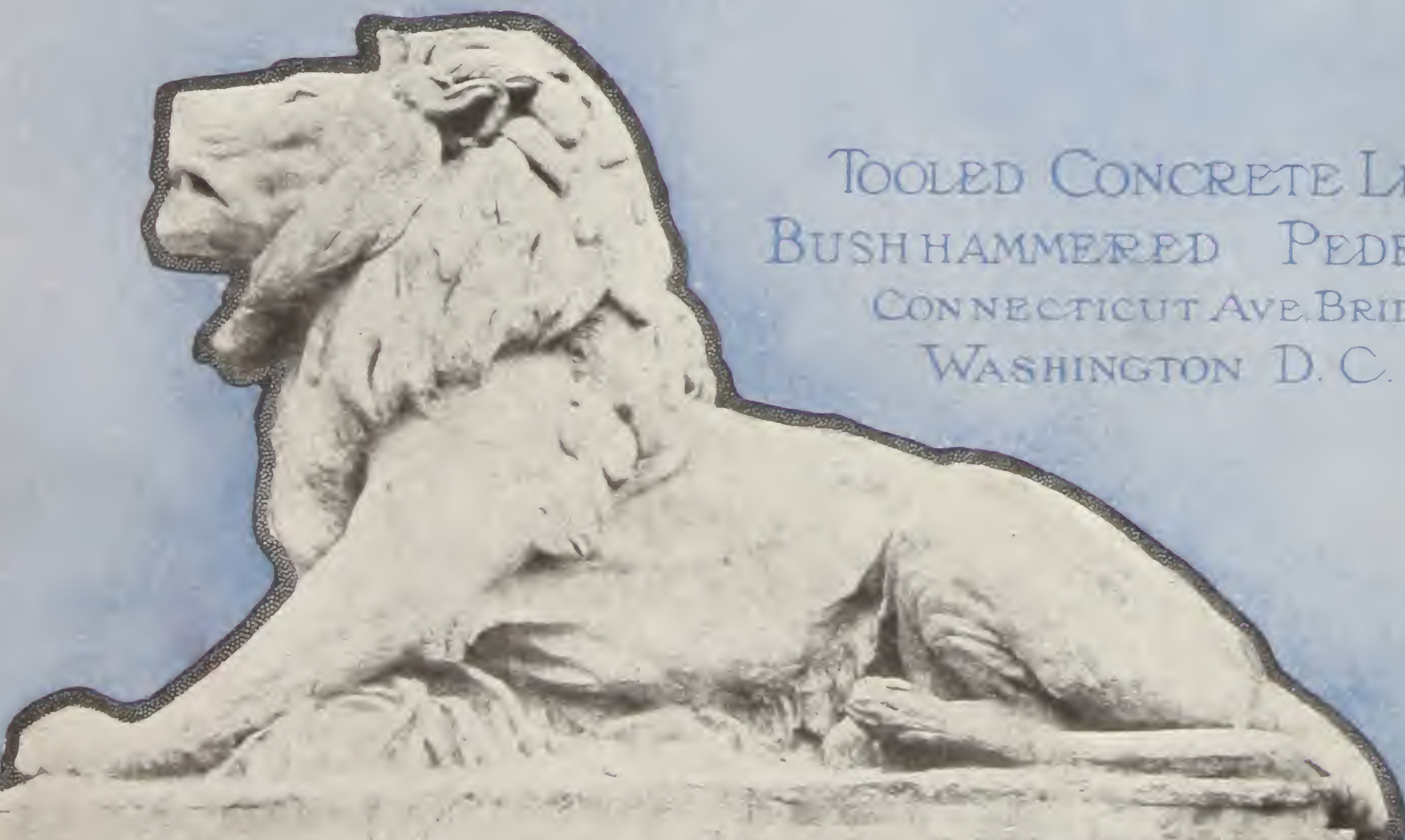
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CONCRETE SURFACES

PUBLISHED BY THE
UNIVERSAL PORTLAND CEMENT CO.
CHICAGO — PITTSBURG

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TOOLED CONCRETE LION
BUSHHAMMERED PEDESTAL
CONNECTICUT AVE. BRIDGE
WASHINGTON D. C.





CONCRETE SURFACES

BY THE
INFORMATION BUREAU
UNIVERSAL PORTLAND CEMENT CO.

PUBLISHED BY
UNIVERSAL PORTLAND CEMENT CO.
CHICAGO — PITTSBURGH
Third Edition
1913



Administration Building,
Washington Park,
Chicago.

Unfinished Surface,
Special mixture.

STATION BUILDING
AND TRAIN

Concrete Surfaces

The proper finishing of concrete surfaces is a problem that is receiving more and more attention each year and the satisfactory results obtained where suitable methods of surface treatment were employed have served to eliminate an unjust objection to the use of concrete for exposed surfaces, where a pleasing and artistic effect, both as to texture and color, is desired.

Next to the general design of a structure, the character of the surface is probably its most noticeable feature and has the most effect on its appearance. No matter how suitable a material may be in other respects, if it does not present a pleasing appearance in its unfinished condition, or if it cannot be finished in an attractive manner its field of usefulness as a building material is limited. Early experience with concrete seemed to reveal a weakness in this respect. The trouble, however, was not with the material, for there is probably none other so well adapted to all classes of construction, but rather to the fact that proper attention was not given to the placing and finishing of the work.

A Building Material must present an Attractive Surface

The ordinary untreated concrete surface it must be admitted is anything but pleasing in appearance, being a comparatively lifeless surface of a somber grayish color. It makes but little difference what cement, sand or aggregate is used or how they are mixed the untreated form surface is the same, and it is this monotonous similarity in appearance of all untreated concrete surfaces that architects object to so strongly.

Surface Treatment a Necessity

There may be the greatest difference in color, shape and texture of the aggregates used in two separate surfaces, yet unless they are so treated as to bring out and expose the aggregate they will look exactly alike. It is quite difficult to distinguish an unfinished concrete surface in which ordinary bank gravel is the aggregate, from one in which crushed red granite, for example, is used, but the same surfaces if subjected to any one or a number of different methods of surface treatment will present a marked and pleasing contrast in appearance.

Value of Suitable Aggregate lost without Treatment

This fact is clearly shown by the colored plates on pages 11, 15, 19 and 23, which are photographic reproductions in color of finished concrete surfaces, identical in every respect, except as to size and character of the aggregate used. By varying the kind, size and proportion of the aggregates, surface finishes of practically any desired color and texture may be obtained, the possibilities being limited only by the number of different aggregates available and their possible combinations. The color is

Color and Texture depend upon Aggregate and Finish

CONCRETE SURFACES



Reinforced Concrete Viaduct
B. & O. Ry.
Philadelphia, Pa.

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obtained from the exposed aggregate, not by adding coloring matter to the mixture. A great variety of finishes may be produced by the use of the common aggregates to be found or easily obtained in nearly all localities, such as limestone, granite or other stone screenings, marble chips and different colored gravels and sands.

To expose the aggregate the film of mortar that flushes to the surface next the forms must be removed. This may be accomplished either by brushing or washing the surface before it has hardened, or by tooling or sand blasting it after it has thoroughly hardened. The method of procedure is as follows:

Treatment
Consists of
Removing
Film of
Surface
Mortar

Having decided upon the general color scheme, the texture of the surface, and the method of surface treatment to be used, the first step is the making and finishing of small sample surfaces. A limited amount of experimenting with materials available will always prove profitable. The color and texture of the finished surface depends upon the color and size of the aggregates used and the successful production of the desired surface is dependent upon the proper selecting, grading, proportioning, mixing and placing of the materials, as well as the finishing of the surface. Upon determining, by experiment, the size and proportion of aggregates required to produce the desired effect, and the proper consistency of the mix, adhere strictly to them. Take the trouble to measure the materials for each batch of facing material and to gauge them with a measured amount of water. The results obtained will more than justify the small additional time and expense this will entail over the all too prevalent method of measuring materials by wheel-barrow loads and adding water with a hose. In fact, uniform results cannot be obtained unless the work is done as pointed out.

Character
of Aggre-
gate and
Treatment
Required
Determined
by
Experiment

Materials
must be
Measured

A pleasing concrete surface cannot be obtained by nicety of form construction alone. The slightest imperfections and irregularities in the form surfaces are transferred to the concrete, producing unsightly surfaces when left unfinished. Where the surface is to be finished after the removal of the forms, all that is required of the forms is that the face lagging be kept true to surface and the joints be tight. For surfaces that are to be finished by brushing but which are too large to concrete in one day, the forms should be so constructed as to permit of the removal of sections of the face form without disturbing the uprights. This can be accomplished by setting the studs or uprights back a few inches from the face lagging and connecting both by means of cleats and wedges. With this construction only enough lumber for one day's concreting is required, the form being shifted up the next day to receive the next course. The forms for the back of the wall may be constructed in the same manner as described for the face forms, but are usually constructed in the ordinary way and left in place until the work is completed. The face forms should also be well oiled to prevent the concrete from sticking to them.

Nicety of
Form
Construc-
tion Unnec-
essary

Special
Form Con-
struction
saves
lumber and
requires
no extra
labor

CONCRETE SURFACES

Buttresses,
Panels and
Joints make
possible the
Joining of
new and
old work

For large areas the introduction of buttresses and panels or the breaking up of the surface by horizontal joints or courses will add greatly to the appearance of the work, the joints simply being indentations in the surface, produced by small triangular, square or rectangular strips of board nailed to the forms. It is extremely hard to join two different days' work so that the joint is not perceptible and unsightly, even when the surface is finished, and the breaking up of the surface as indicated will greatly assist in the concreting if care is taken to end and start a day's work at a course or joint. The results obtained by the use of these strips are clearly shown by the cuts on pages 4, 7 and 9.

Expensive
Aggregate
used only
in Facing
Mixture

Where special or expensive materials must be used to obtain the desired surface finish they are used only in the mixture applied as a facing to the exposed surface. The facing mixture as a rule is from 1 to 1½ inches thick, the remaining thickness of the work being composed of ordinary concrete, but the facing and backing must be deposited at the same time so as to make one solid mass in order to insure a perfect bond.

Application
of Facing
Materials

Concrete blocks, architectural stone and similar work cast in molds where a facing material is used on but one surface should be cast face down. For vertical walls the facing material may be applied to the forms just ahead of the backing which is placed against and rammed into it, or the backing may be placed first and pushed back from the forms with a spade, and the facing material deposited between the backing and the form. Both these methods have been successfully used.

Metal
Facing
Mold
simply
constructed

A third and possibly the best method of placing the facing material on vertical surfaces is by the use of what might be called a metal facing form or mold, consisting of short lengths of iron plates 8 or 10 inches wide and about 6 feet long with three angle irons riveted to each plate. The size of the angle required will depend upon the thickness of the facing material desired. An angle should be placed at the center and one about 6 inches from each end of the plate, one edge of which should be provided with handles and slightly flared to assist in depositing the material.

Use of
Facing
Form

The metal facing form is placed against the wall form with the handles up and the angles tight against the form. The space between it and the back of the wall is filled with ordinary concrete backing and the 1 inch or 1½ inch space between the metal form and the face form is filled with facing material. The metal form is then drawn almost out and after thoroughly tamping the backing against the facing the process is repeated.

Suitable
Facing
Mixture

For the facing material a fairly rich Portland cement mortar or a rich concrete should be used. Rich mortars have a tendency to check and craze, and for this reason mortar containing more than one part cement

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to two parts fine aggregate should not be used. Mixtures of one part cement and $2\frac{1}{2}$ or 3 parts of suitable sand or stone screenings have been found to give excellent results. Where both fine and coarse aggregates are used in the mixture for the facing material a $1:1\frac{1}{2}:3$, $1:2:3$ or even a $1:2:4$ concrete with cement, sand or stone screenings and crushed stone or screened gravel will give good results. The minimum thickness of the facing material should in no case be less than one inch, and where concrete is used not less than twice the maximum dimension of the large aggregate used.



Concrete Foundation,
Indiana Tuberculosis
Hospital,
Rockville, Ind.

Brushed Concrete Surface.
No special facing.

Brushed Concrete Surfaces

Brushing
can only be
done on
Green
Concrete

Where the finish is to be obtained by brushing, the forms must be removed from the work as soon as possible and the concrete surface brushed while still green. It is not possible to state how old work should be before removing the forms and brushing the surface. This will depend upon a number of conditions: the character of the work, cement



Residence,
Evanston, Ill.

Brushed Concrete Surface.
Special facing.

and aggregate used, consistency of the mixture and very much upon the weather conditions. As a rule, in hot weather the forms should be removed the next day and the surface brushed, but in cold weather the facing form cannot be removed so soon, several days or perhaps a week being required for the concrete to obtain the necessary hardness and strength. Care must be taken that the brushing is not started too soon as little particles of aggregate will be removed resulting in a pitted and unsightly surface. On the other hand, the longer the surface stands before being brushed the more brushing it will require to remove the film of

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mortar that has flushed to the surface. The brushing should be started just as soon as it is possible to do so without removing particles of aggregate. The time required for sufficient hardening can only be determined by experimenting with the particular surface.

A brush about four inches wide, made by clamping together a sufficient number of sheets of wire cloth, has been found to be more effective and cheaper than the ordinary wire brush for brushing green concrete surfaces. An ordinary scrubbing brush with stiff palmetto or other fibre bristles will answer if the surface is not permitted to get too hard. The free application of water during the brushing will materially assist in the work.

An easily
made Wire
Cloth
Brush is
best



Detail of residence
on opposite page.

Brushed Concrete Surface.
Special facing.

After the entire surface has been brushed the appearance of the work can be improved by washing with a diluted solution of acid applied with a brush. While wet with acid the surface should be quickly worked over with an ordinary scrubbing brush and the acid immediately removed with clear water applied through a hose. It is important that the surface be thoroughly washed after the acid treatment as otherwise it will have a mottled, streaky appearance. This final acid treatment thoroughly cleans the aggregate, thereby intensifying the color and assists greatly in giv-

Acid Wash
needed to
finish
treatment

BRUSHED CONCRETE SURFACES

of equal parts of black and white marble, red granite, and the same materials as were used in the surfaces shown in Plates 1 and 3.

Plate No. 7 on page 23 shows a surface composed of the same materials as in Plate No. 6 except that the aggregate all passed a No. 8 sieve.

Plate No. 8 shows a surface composed of screened Torpedo sand passing a No. 8 sieve.

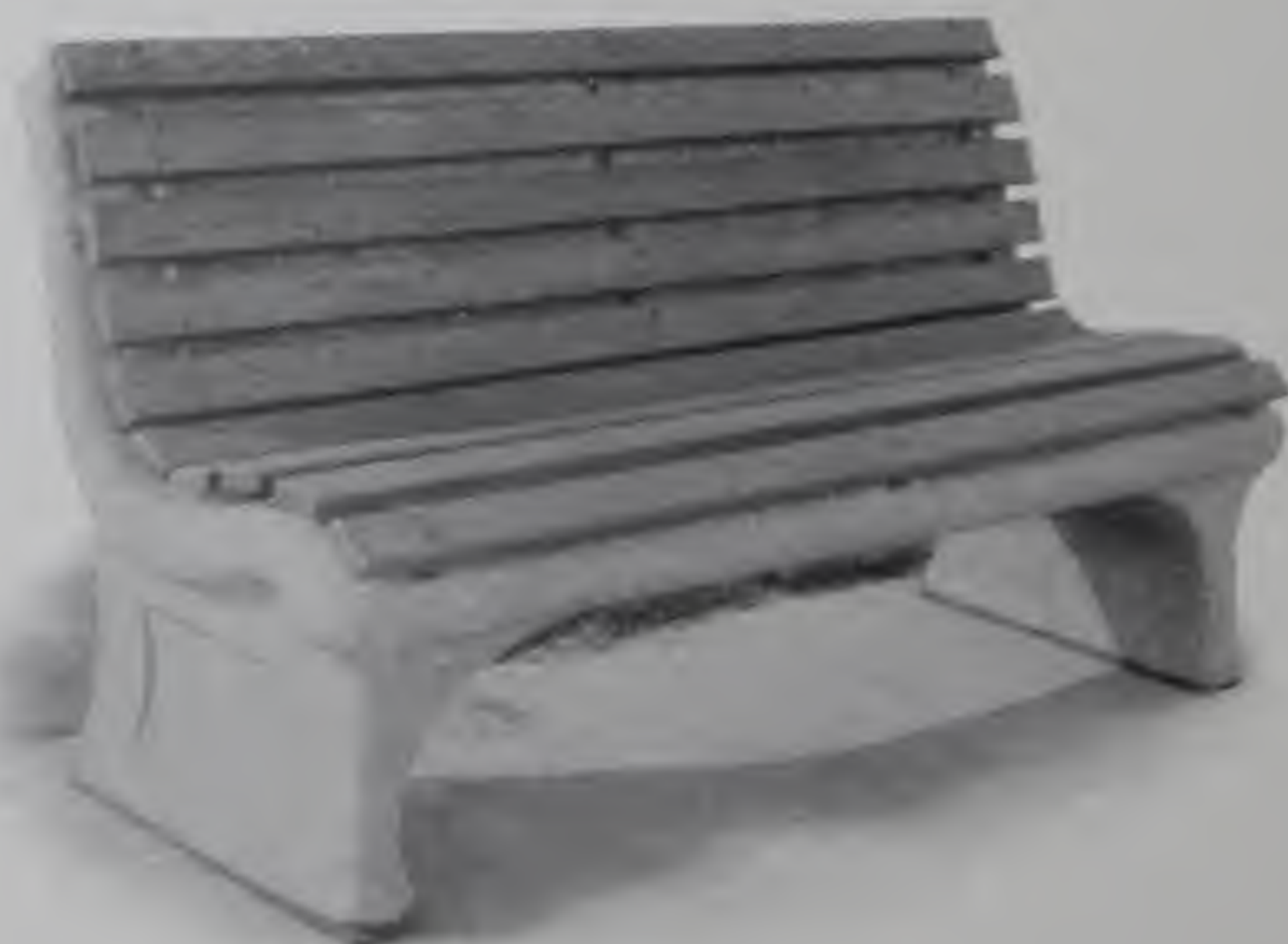
The concrete surfaces represented by these colored plates together with many others, may be seen at the offices of the Universal Portland Cement Company, 115 Adams Street, Chicago, Illinois.

Cheap
Aggregates
used with
good results

A good grade of limestone makes a very acceptable white aggregate to use in place of the more expensive white marble, and both black granite and trap rock make good substitutes for black marble, where a dark surface such as that shown in Plate 3 is desired. By varying the size of the aggregate used, a surface finish of practically any desired texture may be obtained, the size and grading of the aggregate producing nearly as much variation in this respect as its color does in the appearance of finished surfaces. Fine, well graded aggregates produce a comparatively smooth even grain surface of a solid uniform color, whereas large one-size aggregate makes a much rougher surface of not such a solid uniform color.

The Field of
the Brush
Treatment

This method of finishing exposed concrete surfaces by brushing may be used for all types of construction. It is suitable for finishing the surface of concrete blocks and architectural stone where the forms can be removed immediately, as well as for monolithic work, such as foundations, buildings and bridges, where the forms must be left in place for a short time. The cuts shown on pages 7, 8, 9 and 10, give some idea of the variety of actual construction where a desirable surface finish has been obtained by brushing.



Concrete Park Bench,
Lincoln Park, Chicago.

Rubbed Concrete Surfaces

By removing the forms from the work when the concrete is a day or two old and rubbing the surface with a brick of carborundum, coarse concrete or soft natural stone, a desirable surface finish may be obtained.

Method of
Rubbing
Surface
Finish
Surfaces



Retaining Wall,
C. & N. W. Ry.,
Evanston, Ill.

Rubbed Concrete Surface.
Special mortar facing.

With this method of surface treatment the best results are obtained where a facing mixture containing little or no coarse aggregate is used, or where the coarse material has been well spalled back from the face of the work. In connection with the rubbing, a thin grout composed of cement and sand should be applied to the surface, well rubbed in, and the work afterwards washed down with clean water. The grout is used simply to fill surface imperfections and should not remain as a film on the surface.

RUBBED CONCRETE SURFACES

Rubbing
Widely
Practiced

This method of treatment erases form markings and produces a comparatively smooth surface of uniform color much superior to that obtained by the all too prevalent method of painting with a grout, which almost invariably crazes, cracks and peels off. During the past two years a large amount of concrete work has been done in Chicago and its suburbs by the Railroad Companies in connection with their track elevation and the exposed surfaces of concrete abutments and of miles of retaining walls have been given a suitable finish by this method. The present appearance of the work indicates that it makes a very acceptable cheap way of finishing work of this character. The exposed surfaces of the structures shown on pages 13 and 14 were finished in this manner.



Monolith Concrete Station,
C. & N.-W. Ry.,
Evanston, Ill.

Rubbed Concrete Surface
treated with cement stain.
Special mortar facing.



Plate III

$\frac{1}{8}$ " to $\frac{1}{2}$ " Black Marble



Plate IV

$\frac{1}{4}$ " Black and White Marble

TOOLED CONCRETE SURFACES



Detail of bridge above.

UNIVERSAL PORTLAND CEMENT CO.



Connecticut Avenue Bridge,
Washington, D. C.

Bush-Hammered Surface.



Detail of finish of bridge above.

Tooled Concrete Surfaces

Tooling
Gives Best
Results
with small
aggregate

Concrete surfaces may be finished by tooling by any of the methods and in any of the styles employed for dressing or finishing natural stone. Where the surface is to be tooled the best results are obtained when a facing material with comparatively small sized aggregate is used, as it is hard to dress and to obtain uniform results on surfaces where large angular hard stone is encountered. It is not necessary to construct the forms so they may be taken down in sections as was described for brushed surfaces, for the concrete should as a rule be thoroughly hardened before tooling, especially if sharp edges and surfaces of a fine uniform texture are desired.

Rough
Stone-ax
dressing
effective

If the forms are removed when the concrete is two or three days old and the surface is dressed with a hand pick or stone ax, a comparatively large amount of material is scaled off, the finished surface being of a coarse texture similar in appearance to rough dressed natural stone. Some variation in the appearance of the finished surface can be obtained by the manner in which the tool is handled. By striking a perpendicular blow no lines or marks are left in the surface, whereas with a glancing blow, tooth marks are left which can be made parallel to each other or at various angles.

Bush
Hammering
gives
smooth,
uniform
texture

A very desirable finish has been obtained on numerous bridges, buildings and other structures where suitable facing material has been used, by bush hammering the surface, either by hand or with a pneumatic tool. The best results with the bush hammer are obtained on thoroughly hard concrete surfaces. Where a finish of a comparatively smooth uniform texture is desired, especially on surfaces where no facing material or one composed of large aggregate has been used, the concrete should be at least two months old before bush hammering. Otherwise the particles of coarse aggregate are apt to be dislodged instead of cut and exposed, resulting in a pitted instead of a smooth uniform surface. Nine-pound hammers having as many as 36 points on a cutting face four inches square have been used, but the most satisfactory results are apparently obtained with lighter hammers having fewer points. In one case a better finish was obtained and at a less cost by substituting a hammer having 16 points for one having 36 points, and a popular hammer for finishing concrete surfaces is one weighing about three pounds and having but 4 points.

Hammers
best suited



Plate V

$\frac{1}{4}$ " to $\frac{1}{2}$ " Lake Shore Gravel

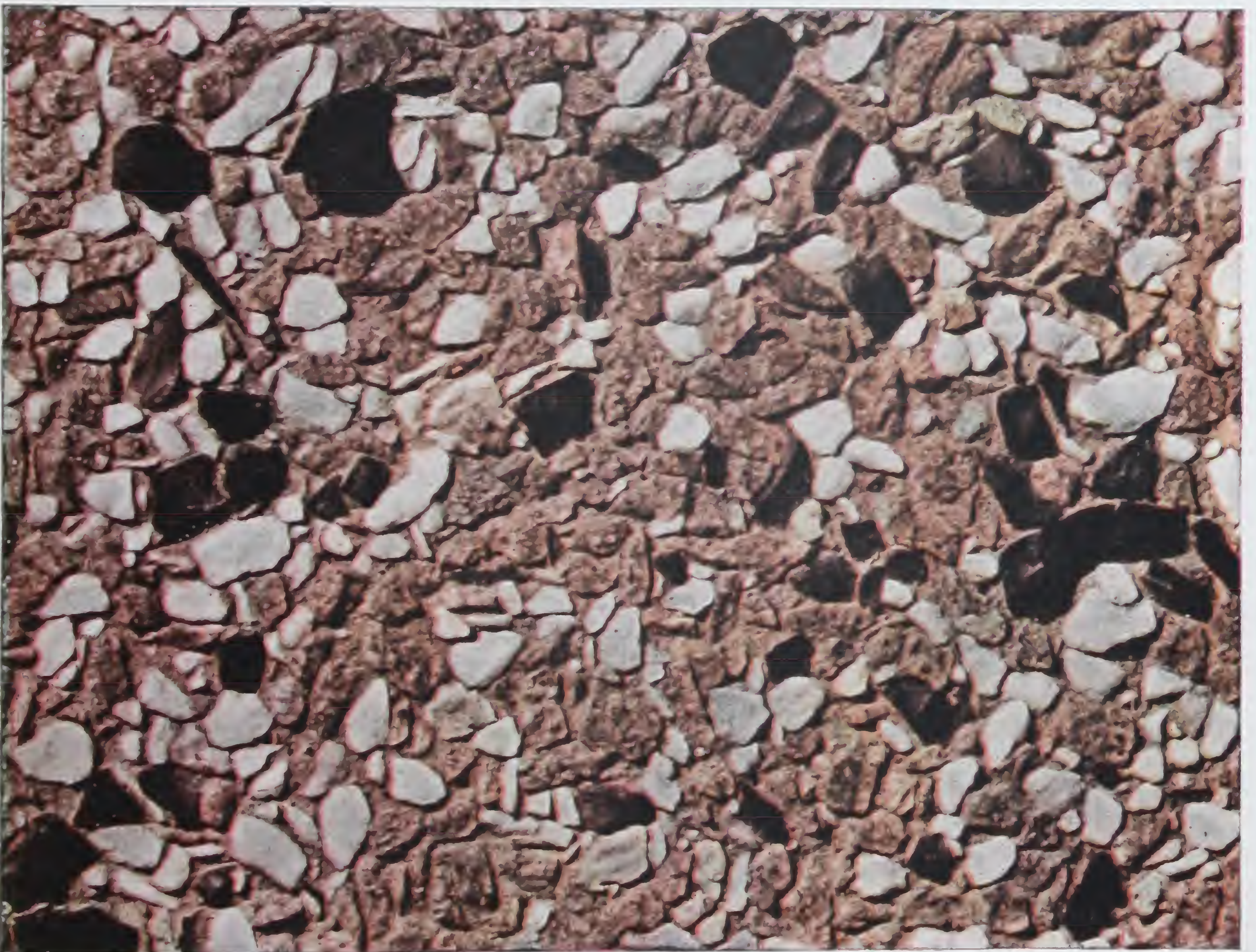


Plate VI

$\frac{1}{4}$ " Black and White Marble and Red Granite

SAND BLASTED SURFACES

Example of
Bush
Hammering
on
Washington
Bridge

The exposed surfaces of the concrete stone used in the construction of the Connecticut Avenue Bridge, Washington, D. C., shown on pages 16 and 17, were faced with a 1:3 mixture of Portland cement and $\frac{3}{8}$ -inch crushed granite screenings and finished by bush hammering. The work was done by hand using patented hammers and skilled labor, and a very good finish closely resembling dressed granite was obtained. The cover of this booklet shows one of the four concrete lions on the approach to the bridge. The concrete pedestal supporting the lion, shown in greater detail on page 17, has a bush hammered surface and the finish obtained here is representative of that of the entire structure.

Sand Blasted Surfaces

Precaution
Needed for
Sand
Blasting

A finish of very much the same texture and appearance as that obtained by brushing while green may be obtained by sand blasting a thoroughly hardened concrete surface. Any pronounced ridges or irregularities in surface, formed by cracks or open joints in the forms should



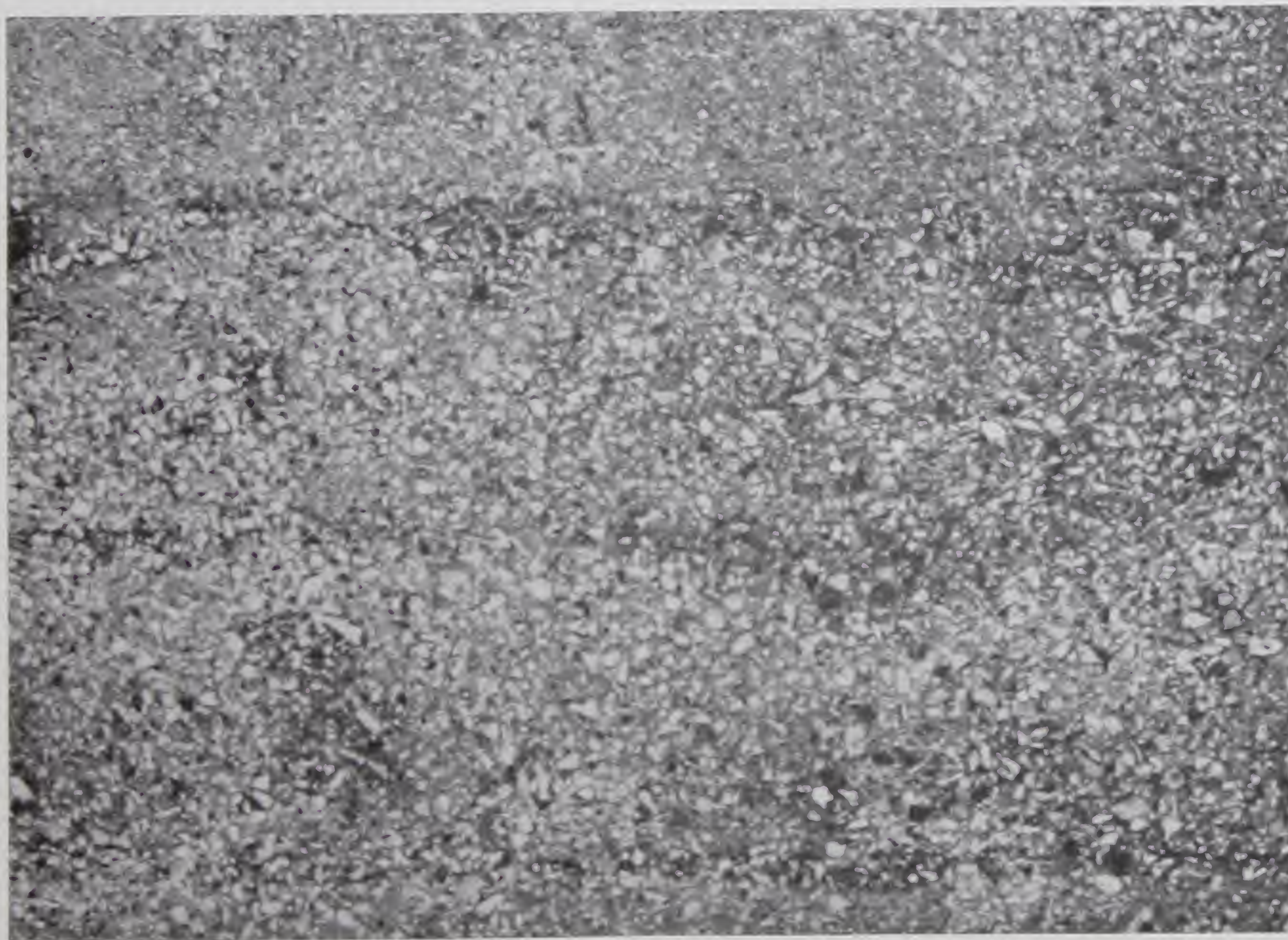
Monolithic Concrete Station,
C. M. & St. P. Ry.,
Columbus, Wis.

Sand Blast Finish.
No special facing.

be removed by tooling and any pointing that may be necessary should be done several days before the surface is sand blasted. In attempting to remove these ridges with the sand blast, the surface on either side is apt to be cut too deep and depressions in the surface intensified or made more prominent instead of being erased. Where it is possible to do so the strips nailed to the forms to make molding, joints and courses, should be left in place while the surface is being sand blasted. Otherwise the sharp angles and edges will be rounded off in a rough and unsightly manner. Leaving the area protected by the strips unfinished adds to, rather than detracts from the appearance of the work, as is to be noted in the cut shown on page 7. When sand blasting near the intersection of two surfaces a board should be held against one in such a manner as to protect the angle or edge, as the case may be, if a clean cut line is desired.

Upon a smooth, dense, thoroughly hardened concrete surface a $\frac{3}{8}$ -inch nozzle may be used, but under ordinary conditions $\frac{1}{4}$ -inch or even $\frac{1}{8}$ -inch nozzles have been found to give the best results. A clean, sharp, thoroughly dried silica sand or crushed quartz is most effective for sand blasting, and for use with a $\frac{1}{4}$ -inch nozzle the sand should be screened through a No. 8 screen, and through a No. 12 when a $\frac{1}{8}$ -inch nozzle is used. The best results are apparently obtained on a thoroughly hardened

Sizes of
Nozzle and
Sand Rec-
ommended



Detail of finish on station, page 20.

COLORED CONCRETE SURFACES

concrete surface at least a month old, and for such work a nozzle pressure of from 50 to 80 pounds will be required.

The surface of the concrete Station shown on page 20 was finished by sand blasting and the cut on page 21 shows in detail the character of the finish obtained.

Colored Concrete Surfaces

Aggregate
Should
Preferably
Furnish
Color

The most satisfactory concrete surface of a given color and texture is obtained by properly finishing a surface faced with a mixture composed of cement and an aggregate of the proper size and color. Such a surface may be considered as permanent, will not deteriorate, scale, fade or require renewing. When aggregates of the required color are not available, or for any reason it is not possible to obtain a surface of the desired color in this manner, satisfactory results may be obtained by what might be termed body coloring and surface coloring.

Method of
Body
Coloring

In body coloring the coloring matter is thoroughly mixed with the materials used in the facing mixture, thereby producing a facing of a uniform color for its entire thickness. The color matter can be used either in a dry form or as a paste. When used dry the most satisfactory results are apparently obtained when the coloring matter is first thoroughly mixed dry with the cement, and this mixture mixed dry with the aggregate before adding any water. Some prefer, however, to mix all the materials together dry in one operation, while others prefer to add the coloring matter to the mixing water.

Mineral
Pigments
Necessary

The ingredients of cement have a strong and generally injurious chemical action upon most of the ordinary pigments. Those of vegetable origin are most susceptible to this action and for this reason for body coloring only mineral colors should be used. Owing to the danger of impairing the strength of the mixture, only a limited amount of coloring matter can be safely used, and it is better to obtain the desired shade by the use of a small amount of a strong though high priced color rather than by the use of a large quantity of a cheap, weak coloring matter. About 5% by weight (of the weight of the cement) is maximum amount of coloring matter that can be safely used. Owing to the fact that the number of pigments available is limited, and that but small amounts of these can be used, the different colors and shades to be obtained by body coloring are comparatively limited. The following table taken from "Cement and Concrete," by L. C. Sabin, shows the colors obtained by the addition of various amounts of different coloring materials.

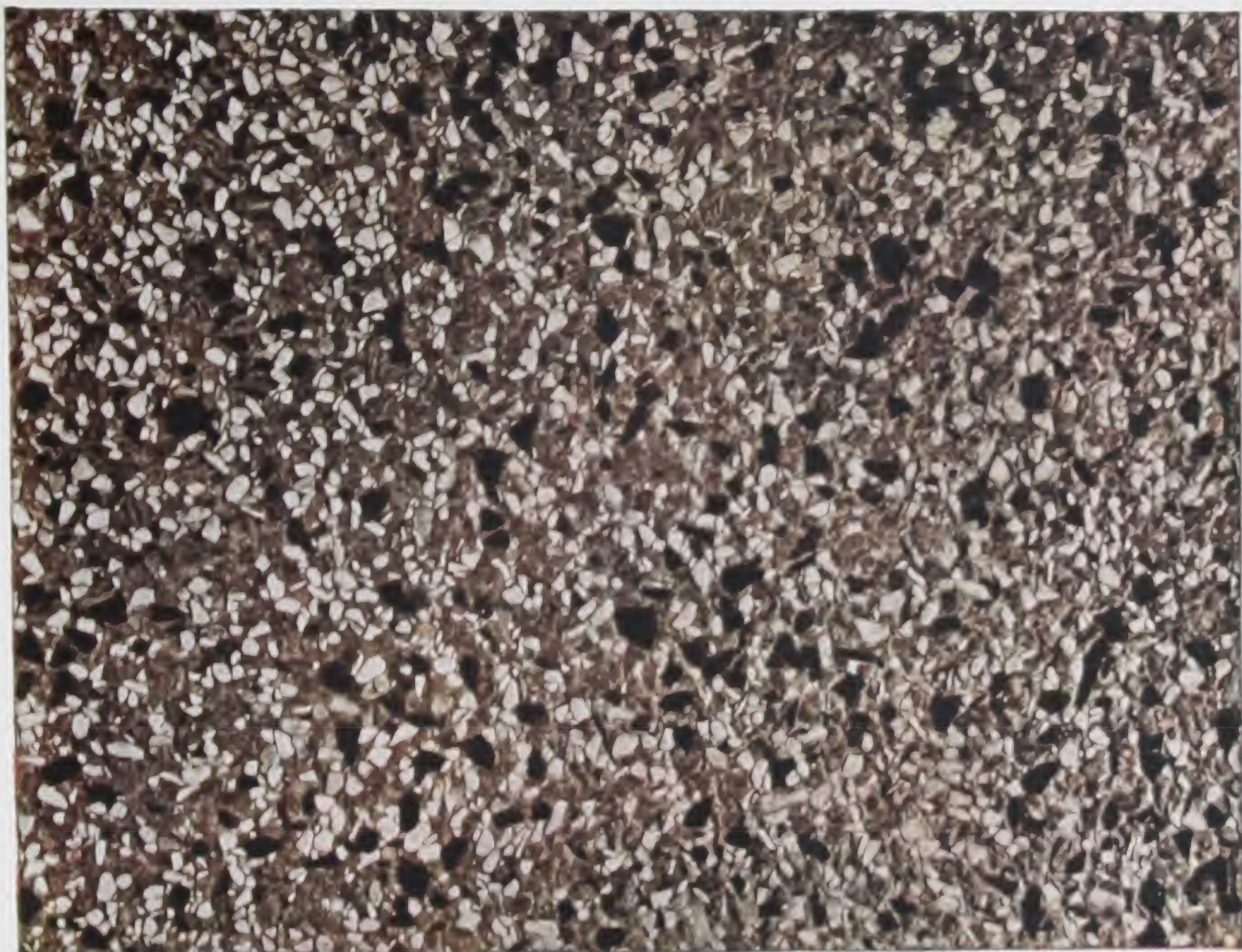


Plate VII

$\frac{1}{8}$ " Black and White Marble and Red Granite



Plate VIII

$\frac{1}{8}$ " Screened Torpedo Sand

COLORED CONCRETE SURFACES

COLORED MORTARS

Colors Given to Portland Cement Mortars Containing Two Parts River Sand
to One Cement

Dry Material Used	Weight of Dry Coloring Matter to 100 Lbs. Cement.				Cost of Coloring Matter per Pound (cents).
	$\frac{1}{2}$ Pound	1 Pound	2 Pounds	4 Pounds	
Lamp Black...	Light Slate..	Light Gray ..	Blue Gray	Dark Blue Slate.....	15
Prussian Blue..	Light Green. Slate	Light Blue Slate	Blue Slate	Bright Blue Slate	50
Ultra Marine Blue	Light Blue Slate	Blue Slate	Bright Blue Slate	20
Yellow Ochre..	Light Green	Light Buff...	3
Burnt Umber..	Light Pink- ish Slate...	Pinkish Slate	Dull Lavender Pink.....	Chocolate...	10
Venetian Red.	Slate, Pink Tinge	Bright Pink- ish Slate	Light Dull Pink.....	Dull Pink ...	2 $\frac{1}{2}$
Chattanooga Iron Ore....	Light Pink- ish Slate..	Dull Pink...	Light Terra Cotta	Light Brick Red.....	2
Red Iron Ore.	Pinkish Slate	Dull Pink...	Terra Cotta...	Light Brick Red.....	2 $\frac{1}{2}$

Surface
Colors
Apparently
Successful

In surface coloring the coloring material is applied as a thin film or coating on the surface after the concrete has hardened. The results to be obtained with ordinary oil paints when used in this manner are questionable and they should not be used upon concrete surfaces, but there are a number of specially prepared paints, cement stains and cement coatings on the market that apparently give splendid satisfaction.

Miscellaneous Surfaces

A method of finishing exposed concrete surfaces has been developed by the engineers of the South Park Commissioners of Chicago, and successfully used by them in the erection of large monolithic concrete buildings. By using a comparatively lean dry mixture for the entire thickness of thin walls and as a facing for heavy walls a concrete surface is obtained which does not take the imprint of the form imperfections and which requires no further treatment after the removal of the forms. For this work they use a mixture composed of about one part cement, one and one-half parts sand and four and one-half parts crushed limestone screenings passing a one-half inch screen, and from which the fine material has been removed by rescreening through a quarter inch screen. The stone is all of approximately one size, being about one-quarter inch material. The concrete is thoroughly mixed so dry that no mortar flushes to the surface when it is well rammed into the forms which are constructed in the usual manner.

A Desirable
Surface
Obtained
by Special
Mixture

The resulting surface has a rough porous texture of a uniform, soft, cement-gray color. Contrary to what might be expected of a surface which absorbs considerable moisture, work that is six years old shows no evidence of injury from frost. It is also possible to obtain sharp clean cut lines for architectural details and moldings, and a surface which remains remarkably free from discoloration due to efflorescence.

Success of
Above
Method

The Administration building facing page 3 shows the type upon which this method of surface finish has been used, and the character of the finish obtained.

In addition to the methods already described, very effective results can be obtained by imbedding colored clay tile or mosaics in concrete surfaces in such a manner as to form patterns and designs. Any one or a combination of different methods can be used in placing the tile. By arranging them in position on a pallet and depositing a cement mortar or concrete around the tile a thin concrete slab containing the desired pattern can be cast and this slab inserted in a space of the required size and depth left in the concrete surface. The tile can also be placed against the forms and the concrete placed directly back of them. This is best accomplished where an elaborate design is worked out by first gluing the tile to a piece of tough, thin paper which in turn is glued or otherwise fastened in the proper position to the forms. Still another method is to set the tile, piece by piece, in recesses of the required depth and outline left in the surface of the wall.

Colored
Clay
Inserts

SURFACE FINISH FOR CONCRETE BLOCKS

The recesses in the concrete surface for the tile are formed by nailing boards of the required thickness and outline on the inside of the forms. These pieces of board should remain in the wall after the removal of the wall form and should be left in place until the concrete surface is given the desired finish.

A good example of decoration by inlaid tiles is shown on page 30.

Surface Finish For Concrete Blocks

Blocks
Susceptible
to All
Foregoing
Treatments

For but a fraction of the cost of quarrying, dressing and preparing a natural stone for use, a suitable concrete block can be manufactured, which if given a proper surface finish will be as acceptable for any class

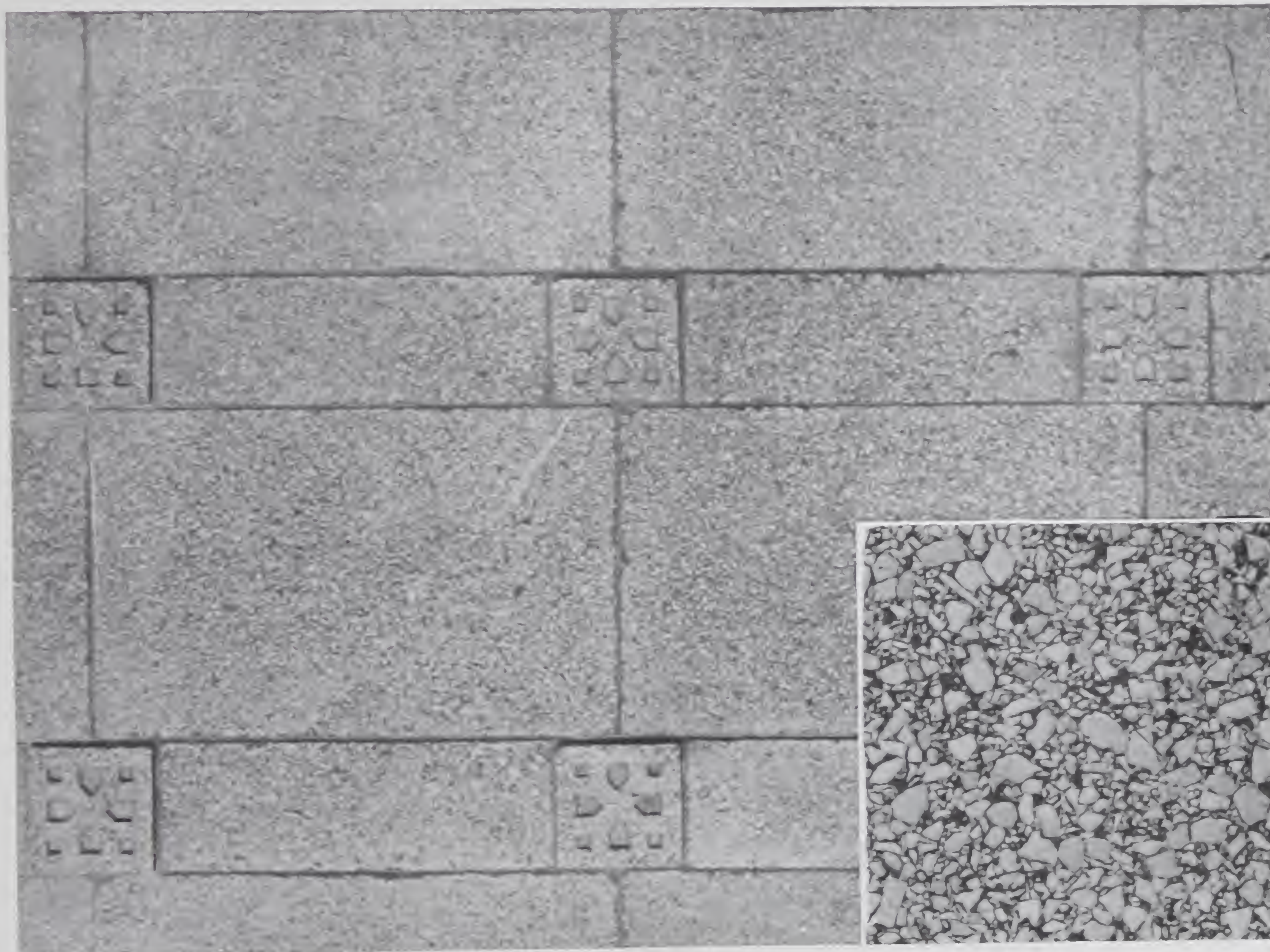


Office Building,
Buffington, Ind.

of construction as the more expensive natural stone. All of the methods described are especially well adapted for use in finishing the exposed surface of concrete building blocks and architectural stone, where it is possible to remove the forms, and brush, tool, rub or sand blast the surface at the most opportune time.

The blocks shown in cuts on this page were faced with a 1:2 mixture of cement and limestone screenings, and finished by placing them on

Blocks with
Ground
Face



Detail of finish on office building, page 26.

a revolving metal disk covered with wet lake sand where the exposed face was ground down to a smooth uniform surface. By this effective cheap method a concrete block of a distinctly pleasing and unusual appearance was obtained.

A novel method of facing concrete blocks has been developed at the State Hospital, Yankton, So. Dak., and the blocks have been extensively used for the construction of many large buildings there, and at the State Hospital at Elgin, Ill. The blocks can be correctly called "rockface" as they are faced with thin pieces or chips of granite of irregular shapes and sizes, split by hand from larger pieces.

True
"Rock
face"
Blocks

These concrete blocks are cast face down in long gang molds having metal sides separated by metal plates. These plates are cut to a size to

SURFACE FINISH FOR CONCRETE BLOCKS

conform to the desired section of the block, and are so spaced between the sides as to make blocks of the required length. The metal forms are placed on long boards of the required width which serve as pallets.

Special Block Mold and Its Use

A layer of sand about one-half inch thick is first spread over the bottom of the form, and upon this sand the stone facing is laid. No special care is taken in arranging the stones except that they are placed as close together as is possible without overlapping. A rich mortar consisting of one part cement and one part sand mixed very wet is then poured into the forms, sufficient mortar being used to practically cover the stone. Immediately after pouring the mortar the forms are filled with ordinary concrete mixed about one part cement to two and one-half parts sand and five parts crushed stone or screened gravel. The blocks are left in the forms until the following day when they are removed, stored and cured as is customary with ordinary concrete blocks and without further treatment are ready to be placed in the wall.

The cuts shown on this and the opposite page will give some idea of the results to be obtained by this method of facing concrete blocks.



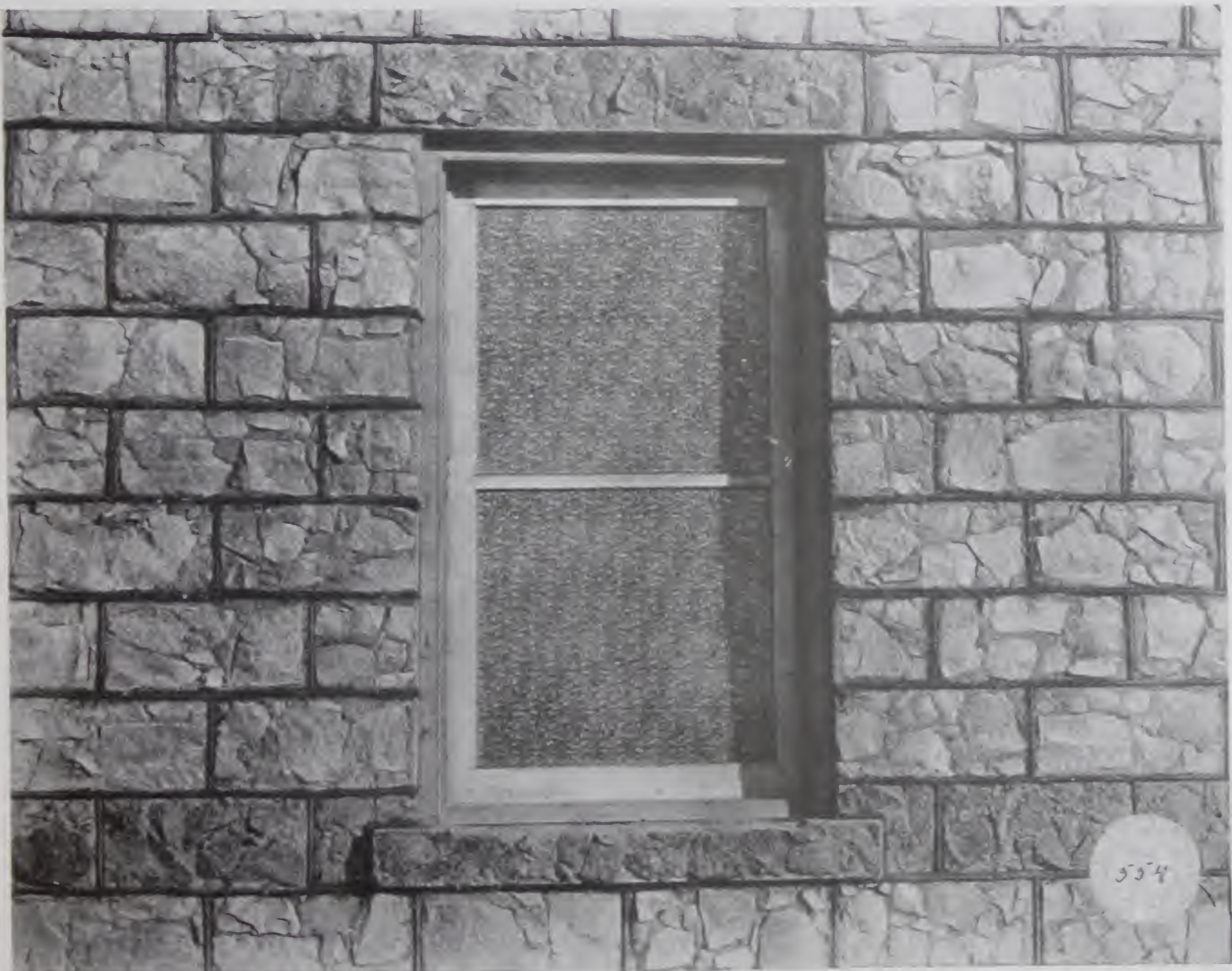
Concrete Block Cold Storage
Building, State Hospital,
Elgin, Ill.

Blocks Faced with
Natural Stone.

Cost of Finishing Concrete Surfaces

Owing to the fact that but little attention has been given heretofore to the proper finishing of exposed concrete surfaces, there is comparatively little reliable data available concerning the cost of this class of work. Records of the actual cost of finishing surfaces by the methods enumerated have been kept in but few cases and the estimates furnished for doing such work show a wide variation.

The additional cost of a finished, as compared with an unfinished concrete surface, is made up of two separate items; the cost in place, of the special facing mixture, and the cost of finishing the surface after the forms are removed. Where the work is carefully planned beforehand there should be no additional cost for forms. In fact, some contractors consider that there is an actual saving in the cost as it is not



Detail of blocks used in building shown on opposite page.

COST OF FINISHING CONCRETE SURFACES



Fireplace on south porch,
Mr. Albert Moyer's
Residence.

Surface Decoration with
Colored Clays.
Special Facing.

UNIVERSAL PORTLAND CEMENT CO.

necessary to use the better grades of dressed lumber and less care need be taken in assembling the forms.

A suitable facing 1 inch in thickness, composed of a standard Portland cement mortar or concrete with ordinary sand or stone screenings and crushed stone, can be placed at a total cost for materials and labor from about 2 to 3½ cents per square foot. Where white cement and an expensive aggregate, such as crushed marble, is used the cost of this facing will be proportionally higher. To this cost must be added the cost of finishing the surface after the removal of the forms. This will depend upon the method adopted, the condition and age of the surface and on the character of the work.

Cost of
Facing
Mixture

A thoroughly hardened plain concrete surface can be finished by bush hammering by hand, at the rate of from 50 to 100 square feet per day. With common labor at \$1.75 per day the cost would be from 1¾ to 3½ cents per square foot. Skilled labor will furnish about the same amount of work but it will be of a better quality and the cost will be increased by the difference in the cost of labor. With pneumatic hammers and labor at \$2.00 per day a very good surface has been obtained on concrete bridges at a cost of about 3 cents per square foot.

Cost of
Bush
Hammering

Low, plain concrete walls, such as foundations, where it is not necessary to use scaffolding, have been finished by brushing at a cost of 1½ to 2 cents per square foot with labor at \$1.75 per day. The cost of brushing more elaborate surfaces, and where scaffolding has to be used, will vary from 2 to 4 cents per square foot.

Cost of
Brushing

Finishing green concrete surfaces by rubbing as described with bricks of carborundum, emery, or natural stone will cost from 1½ to 3 cents per square foot. On one large job where a careful record was kept of cost of removing the face forms and finishing the surfaces of concrete retaining walls was found to range from 1¾ to 3 cents per square foot of exposed surface. The wall varied in height from about 2 ft. up to about 18 ft. On the sections where it was necessary to use scaffolding the cost of finishing was greater than where the men removing forms and finishing the surfaces worked from the ground.

Cost of
Rubbing

Sand blasting the surface of thoroughly hardened concrete will cost about the same as bush hammering with an automatic tool. Only a comparatively large amount of work will justify the cost of setting up and operating a sand blast or an automatic tool outfit.

Cost of
Sand
Blasting

The appearance of surfaces finished by brushing, tooling, rubbing or sand blasting is greatly improved by washing them with a dilute solution of acid and clean water. This work can be done by common labor and the cost should be but a fraction of a cent per square foot.

Cost of
Acid Wash

That concrete surfaces can be so finished as to present a decidedly attractive appearance is demonstrated by the results obtained on the

COST OF FINISHING CONCRETE SURFACES

limited number of structures and surfaces shown in this booklet. To produce the desired effect exposed concrete surfaces should be faced with a suitable facing mixture and finished by one of the methods described. The first cost of such work will practically be the total cost. There should be little or no additional expense for up-keep as a properly finished concrete surface can be considered as permanent, will not deteriorate or require renewing, and when soiled as all exterior surfaces eventually are may be cleaned at a small cost by washing with a dilute acid solution and clean water.

By brushing, tooling or sand blasting a concrete surface all traces of form markings are erased, the film of mortar that flushes to the surface next the forms is removed, thereby exposing the aggregate, and a rougher more artistic surface is produced. The roughness of the surface breaks up the light, the color of the exposed aggregate adds color and life, and a pleasing, artistic concrete surface is obtained.

Considering the marked improvement in the appearance of finished over form work, it is remarkable that so little attention has been given heretofore to the proper finishing of exposed concrete surfaces, and it is hoped that this booklet will serve as an incentive for increased activity in this respect.

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BY

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CHICAGO—PITTSBURGH—MINNEAPOLIS





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